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ing, cultivation. In contrast to this method, advanced agriculture is practiced year after year on the same well tended plot, the fertility of which is maintained by manuring, crop rotation, intensive cultivation, terracing, and often the regular addition of mineral matter in the form of silt deposited on the land by irrigation water. Only occasionally may the land be allowed a short fallow period. This type of tillage may be called permament-field, or sedentary, cultivation.[10]

Shifting cultivation and sedentary cultivation are generic terms used to describe fundamental differences in land use, differences that find their outward expression in the cultural landscape created by those who maintain these economies.[11] Can there be a greater contrast than that between the shifting cultivators' small, irregular, temporary clearings with their chaotic jumble of fallen and half-fallen tree trunks and stumps, on the one hand, and, on the other, an irrigated plain, subdivided into small fields, each surrounded by a dyke—or a steep slope where a succession of beautifully built terraces leads up for several hundreds or even thousands of feet? These kinds of landscape are physical expressions of totally different economies, or modes of life, with different cultural patterns, concepts of land tenure, attitudes toward the soil, and material equipment.

Historically, shifting cultivation without doubt antedates sedentary cultivation, which requires among other things more elaborate techniques and deeper insight into the relationships between soil, tillage, and yields.

Shifting and sedentary cultivation may each be further classified in terms of tools, as we have seen, or in terms of crops, systems of rotation, and the like.[12] For instance, in terms of crops, we may distinguish between grain and grainless culture. Of the two, grainless culture is generally conceded to be the older. One argument for this thesis is that fruits and many of the root and leaf crops may be eaten raw or simply prepared, whereas cereals require more elaborate preparation. The fact that grainless agriculture is largely confined to the fringes of Southeastern Asia also supports the thesis that, at least in this region, grainless agriculture preceded the cultivation of cereals. Still further substantiation is found in Polynesia, where the inhabitants cultivated no cereals when they were first visited

[10] Although sedentary cultivation is commonly practiced by people who use plows drawn by animals, there are large areas where it is practiced with little or no use of the plow. Such areas are found in parts of the Philippines, Java, Sumatra, and southern China, where steep hillsides have been terraced and where the nature of the terrain makes the use of work animals impossible. Sometimes individual farms or patches of land are so small that they must be tilled with hoes, even though plows may be used on adjacent farms. In places custom and religious tradition forbid the use of plows and draft animals.

[11] Waibel: Probleme der Landwirtschaftsgeographie, 1933, p. 11.

[12] For example, we may distinguish: (a) shifting dibble cultivation, shifting hoe cultivation, and shifting plow cultivation; (b) grainless shifting cultivation and shifting grain cultivation; (c) shifting field-forest cultivation and shifting field-grass cultivation; (d) permanent plow cultivation and permanent planting-stick cultivation; (e) permanent four-field cultivation, and so on. Not all of these are found in Southeastern Asia.

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part of the government and of missionaries to introduce terracing and wet-rice cultivation but, instead, continue to practice shifting cultivation and to depend upon dry rice as their staple food.

Wherever we find shifting cultivation the density of population is low; on the other hand, permanent cultivation provides the basis for higher densities. The higher the density, the greater is the care bestowed upon the cultivation of the soil. The development of permanent-field cultivation, the construction of terraces on mountainsides and hillsides, the dyking and draining of plains, and other complex techniques associated with wet-rice cultivation are but expressions of a population density that demands an intensive utilization of the soil and a maximum production of food crops.

The areas where wet rice was first cultivated were probably hollows and small valleys and the well watered slopes of low hills rather than the great plains and wide valleys that are today the rice granaries of the world. The utilization of extensive plains and broad river valleys for the cultivation of wet rice requires a social organization unknown to the peoples who first began wet-rice culture.

It is thought that the cultivation of wet rice originated in days when the hoe and the dibble stick were the only agricultural tools, that is, before the animal-drawn plow reached Southeastern Asia. The broadcasting of seeds is held to be characteristic of plow culture, whereas the cultivators of wet rice in Monsoon Asia generally plant their rice seedlings in the manner of shifting cultivators,[29] a circumstance that would seem to support the hypothesis that the carabao and the plow were not a part of the original technique but were adopted later. Even today wet rice is raised in some parts of Southeastern Asia without the use of the plow. For example, peoples in central Celebes prepare their fields for cultivation by driving carabaos back and forth until the fields are thoroughly puddled.[30] In other areas where wet-rice fields are built on such steep slopes that it is impossible to get carabaos to the terraces, farmers are frequently obliged to till their land entirely by hand—employing only such tools as wooden spades and sticks, which may be shod with iron. The Ifugaos of northern Luzon, for example, have terrace walls reaching, in some cases, heights of 60 feet or more that can be scaled only by means of rocks jutting out from the faces of the walls.

Although most sedentary cultivators in Southeastern Asia make use of

[29] Although rice growers in other parts of the world generally use the broadcast method of sowing, one finds it in Southeastern Asia only as a rare exception. According to Copeland (*op. cit.*, p. 224) the *sabog*, or broadcasting method, is used in the Philippines over a rather limited area. This method produces lower yields but its advantages are "some saving of time, saving the labour of transplanting, and the possibility of maturing a crop with less water; rice grown directly in its place can get along with less water than transplanted rice." According to Kruyt ("De To Rongkong in Midden-Celebes," 1920, p. 380), the To Rongkong of central Celebes transplant their wet rice only in exceptional cases but usually broadcast it.

[30] Kruyt: "De To Seko in Midden-Celebes," 1920, p. 409.

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Although most sedentary cultivators in Southeastern Asia make use of the animal-drawn plow, in the densely populated regions the parcelling of land has proceeded so far that many peasants, whose fathers, or ancestors, owned draft animals (carabaos or oxen) and used plows, have farms so diminished in size that they cannot afford to keep draft animals and therefore must till their fields entirely with hand tools. In spite of the fact that they often make very intensive use of their fields, still they are not able to produce enough to meet the modest needs of their families.

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In nearly all instances, however, where the governments concerned have attempted to solve this problem by opening up land suitable for sedentary cultivation to settlers coming from problem areas, the governments have been confronted by the fact that these districts, which might offer outlets for the congested areas, are inhabited by shifting cultivators or in some cases by food gatherers. The danger is then that the proposed migration may infringe upon the rights of the indigenous peoples, whose economy and mode of life, as we have noticed, require considerably more land than those of the incoming settlers, who are accustomed to permanent-field cultivation. It is, therefore, necessary for us to understand the various forms of land use in Southeastern Asia and their peculiar exigencies in order rationally to approach the problems of pioneering in the countries around the South China Sea.

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estation is not a discovery of Western-trained scientists but has long been practiced by certain groups in Southeastern Asia. It was the plan of the government to spread and enforce this practice of artificial reforestation wherever advisable. This practice, whereby the cultivator determines the vegetative cover during the fallow period instead of abandoning the ladang to chance growth, brings him to a transition stage between shifting cultivation and permanent cultivation. From there the step to permanent cultivation with crop rotation is but a short one.

Permanent cultivation requires repeated tilling and therefore more labor and tools than the shifting cultivator is accustomed to. Work animals are also desirable. An important obstacle to intensification of agriculture in wide areas of Southeastern Asia, however, is the fact that hill and mountain regions [up to about 1500 meters in elevation] are frequently infested with malaria so that the energy of the people is greatly reduced.[45] Moreover, the acquisition of such implements as plows, harrows, and hoes, and especially of work animals, calls for financial resources or credit, both of which the average shifting cultivator lacks. Some shifting cultivators do own livestock, such as cattle or carabaos, but utilize neither their labor nor their manure. Groups of the Mois in the mountains of Annam have carabaos, but they do not use the animals in their agricultural activities because they "cannot talk" to them.[46] On the Lesser Sunda Islands livestock is kept because it gives social prestige to the owner. Overstocking of the pasture areas on these islands has led to overgrazing and has cut into the forest area until there has developed a scarcity of land suitable for ladang cultivation. The same has happened in large areas in Africa. There it has been necessary to teach the native peasant the use of cattle and make him familiar with the plow. This was done successfully in northern Nigeria by combining the animal husbandry of the nomadic Fulani with the indigenous shifting cultivation of the Hausa peasant, thus developing "a system of permanent farming whereby a man with cattle of his own, say two working oxen and a few cows, can plough and maintain in fertility an area of land sufficient to supply all the requirements of himself and his family, and to obtain a surplus balance as a return for his labour. . . . Thus mixed farming represents a gradual evolution from the shifting methods of cultivation to a static type of agriculture, by the introduction of animal husbandry, and with the use of animal cultivation."[47] Above all, the peasant learns to preserve the animal manure and

a shade tree; *Dolichos lablab* L., a climbing herb which is valuable as a vegetable; *Crotolaria anagyroides* H.B. and K., a bush of vigorous growth which attains a height of from 12 to 14 feet and forms an excellent green manure; *Tephrosia candida* DC. and *Tephrosia vogelii* Hook., low shrubs useful as green manures; and *Mimosa invisa* Mart., a leguminous creeper which suppresses grasses.

45 Gourou: L'utilisation du sol, 1940, pp. 181 and 350.

46 *Ibid.*, p. 354.

47 King: "Mixed Farming in Northern Nigeria," 1939, p. 271. See also Faulkner and Mackie: West African Agriculture, 1933; and by the same authors: "The Introduction of Mixed Farming in Northern Nigeria," 1936, pp. 89–96.

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to apply it regularly to his fields in order to keep up the fertility which formerly was restored through long forest fallow. This animal fertilizer is more important than the help the peasant gets from his animals in the way of labor. Thus the area to be cultivated may be limited by the amount of manure available, rather than by the extent of land that can be plowed.

Van Beukering, in his summary of the results of the ladang *enquête*, is of the opinion that similar practices should be introduced in the Outer Islands of the Netherlands Indies; but the pasture problem must first be carefully studied before mixed farming can be widely established in the Indies. Where animal manure is not available, the composting of vegetable waste, or even of crops grown for this specific purpose, supplies an excellent fertilizer.

The intensification and modification of shifting cultivation are less difficult in flat country than on sloping land where there is the hazard of soil erosion. Perhaps the most obvious solution would be to move the population from mountainous land to the plains and valley floors, but this can be done only in areas where population density is low. In Southeastern Asia the density of population on the plains is usually so high that, should it be possible to bring malaria under control, a movement from the plains to the uplands and mountains would be desirable rather than a migration in the opposite direction. Another solution would be to have the shifting cultivator plant permanent tree crops to protect the soil against accelerated erosion. Steep slopes which now produce but a single moderate rice crop every few years could be made more productive if planted with perennials. The cultivator could then buy his staple food with the money obtained from the sale of the crops harvested from his trees.

The speed with which the change from shifting cultivation to permanent cultivation may be made will depend both on the geographical environment and the cultural level of the community. Shifting cultivators with permanent villages and a regularly established rotation of fields will respond much more readily to a reform brought from the outside than a group that is always ready to abandon its dwellings and move to a new locality.

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241 to a group, the individuals of which choose or are given, every now and again, different portions to cultivate for themselves.

• 231 Within Southeast Asia the shifting cultivation system has no relation to the needs of domesticated animals. There is no evidence here that the simpler tribes have been primarily cattle grazers, except in so far as all Mongoloid types coming south overland

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FIG. 111.—The Accessibility of Southeast Asia by Land

231 from the grazing grounds of Tibet and farther north may, at remote times outside this territory, have been associated with animals. Inside Southeast Asia, cattle do not fit well into the ecology of climate, vegetation and pests, and the disinterest in animals has become part of the religious tradition; Buddhists and Hindus do not eat beef, Muslims will not eat pork and even the primitive animists have similar inhibitions. Wherever today there has grown up a cattle system, it relates to the ploughing needs and is concerned with buffaloes or small oxen and does not derive from an earlier tradition of cattle farming or nomadism.

241 Shifting cultivation is a system well adapted to large empty areas where soils are poor and the rate of soil erosion high. As soon as population increases, shifting cultivation, which needs each cutover area to stand unused for 7 to 10 years before being